Claims

1. A device for detecting correlated radiative emissions from a sample, comprising:

a chamber that substantially contains the sample, the chamber being permeable to an incident subatomic particle entering the chamber and interacting with the sample, thereby causing the sample to emit a first emitted radiative emission and a second emitted radiative emission; and

a detector that detects a first interaction with the first emitted radiative emission and detects a second interaction with the second emitted radiative emission.

2. The device of claim 1, further comprising a correlating system that correlates the first and second emitted radiative emissions to a single exotic atom in the sample in any of: a temporal correlator and a spatial correlator.

3. The device of claim 1, wherein the detector comprises a scintillation detector.

4. The device of claim 1, wherein the detector comprises a liquid scintillator.

5. The device of claim 1, further comprising a spectrometer that measures a spectral characteristic of at least one of the first and second emitted radiative emissions.

6. The device of claim 1, wherein the detector is segmented into a plurality of segments.

7. The device of claim 1, wherein at least one of the first and second emitted radiative emissions are produced in an electronic shell transition of an exotic atom in the sample.

8. The device of claim 1, wherein at least one of the first and second emitted radiative emissions are produced in a nuclear interaction of an exotic atom in the sample.

9. The device of claim 1, wherein the incident subatomic particle is negatively-charged.

10. The device of claim 9, wherein the particle is a muon.

11. The device of claim 9, wherein the particle is a pion.

12. The device of claim 1, further comprising a source of incident subatomic particles that excites the sample into an exotic state.

13. The device of claim 1, further comprising a processor that analyzes a characteristic of the emitted radiative emissions.

14. The device of claim 13, wherein the characteristic is an energy level.

15. The device of claim 13, further comprising a comparator that compares the characteristic of the emitted radiative emissions with a known characteristic.

16. The device of claim 1, further comprising a multiplier that multiplies a detected signal from the detector to generate a multiplied signal.

17. The device of claim 1, further comprising a correlator that correlates a first signal due to the first interaction and a second signal due to the second interaction.

18. The device of claim 17, wherein the correlator comprises a circuit that selectively determines occurrence of the first and second interactions within a temporal window.

19. The device of claim 1, further comprising an incident particle sensor that senses a trajectory of a radiative emission.

20. A method for determining a correlation between two emitted radiative emissions and a detector, comprising:

(A) detecting a first radiative emission from deexcitation of an exotic atom;

(B) detecting a second radiative emission from deexcitation of the exotic atom; and

(C) correlating the first and second radiative emissions detected in (A) and (B) to determine a correlation between the first and second radiative emissions.

21. The method of claim 20, wherein at least one of the first and second radiative emissions is an energetic photon.

22. The method of claim 20, wherein at least one of the first and second emitted radiative emissions is a neutron.

23. The method of claim 20, wherein correlating the first and second radiative emissions comprises determining a temporal window within which the first and second radiative emissions occur.

24. The method of claim 20, further comprising providing exciting an atom to yield the first and second radiative emissions.

25. The method of claim 24, wherein exciting the atom comprises providing an incident subatomic particle to yield an exotic atom.

26. The method of claim 25, wherein the subatomic particle is a muon.

27. The method of claim 25, wherein the subatomic particle is a pion.

28. The method of claim 20, further comprising measuring a characteristic of the radiative emissions.

29. The method of claim 28, further comprising comparing the measured characteristic of the radiative emissions with a known characteristic.

30. A device for screening objects, comprising:

a chamber that substantially contains an object to be screened; and

an X-ray detector that detects at least one characteristic X-ray emitted by an excited (exotic) atom within the object;

wherein the exotic atom emits the characteristic X-ray on transitioning from a first (high-energy) atomic state to a second (low-energy) atomic state.

31. The device of claim 30, wherein the first and second atomic states correspond to first and second electronic states of the atom.

32. The device of claim 30, further comprising an X-ray spectrometer, coupled to the X-ray detector.

33. The device of claim 32, further comprising a processor that processes signals from the X-ray spectrometer.

34. The device of claim 33, further comprising a storage system coupled to the processor, the storage system containing data that associates the plurality of characteristic X-rays with a known set of characteristics identifying the atom.

35. The device of claim 30, further comprising a neutron detector that detects characteristic neutrons emitted by a nucleus of the atom.

36. An apparatus for correlating radiative emissions from an exotic atom, comprising:

means for detecting a first radiative emission from deexciting the exotic atom;

means for detecting a second radiative emission from deexciting the exotic atom; and

means for correlating the first and second radiative emissions to yield a correlation between the first and second radiative emissions.

37. The apparatus of claim 36, wherein the means for detecting any of the first and second radiative emissions is an X-ray spectrometer.

38. The apparatus of claim 36, wherein the means for detecting any of the first and second radiative emissions is a neutron detector.

39. The apparatus of claim 36, further comprising means for determining a time difference between detection of the first and second radiative emissions.

40. The apparatus of claim 36, further comprising means for exciting the atom to an exotic state with an incident subatomic particle.

41. The apparatus of claim 40, wherein the subatomic particle is a muon.

42. The apparatus of claim 40, wherein the subatomic particle is a pion.

43. The apparatus of claim 36, further comprising means for measuring a characteristic of the radiative emissions.

44. The apparatus of claim 43, further comprising means for comparing the measured characteristic of the radiative emissions with a known characteristic.